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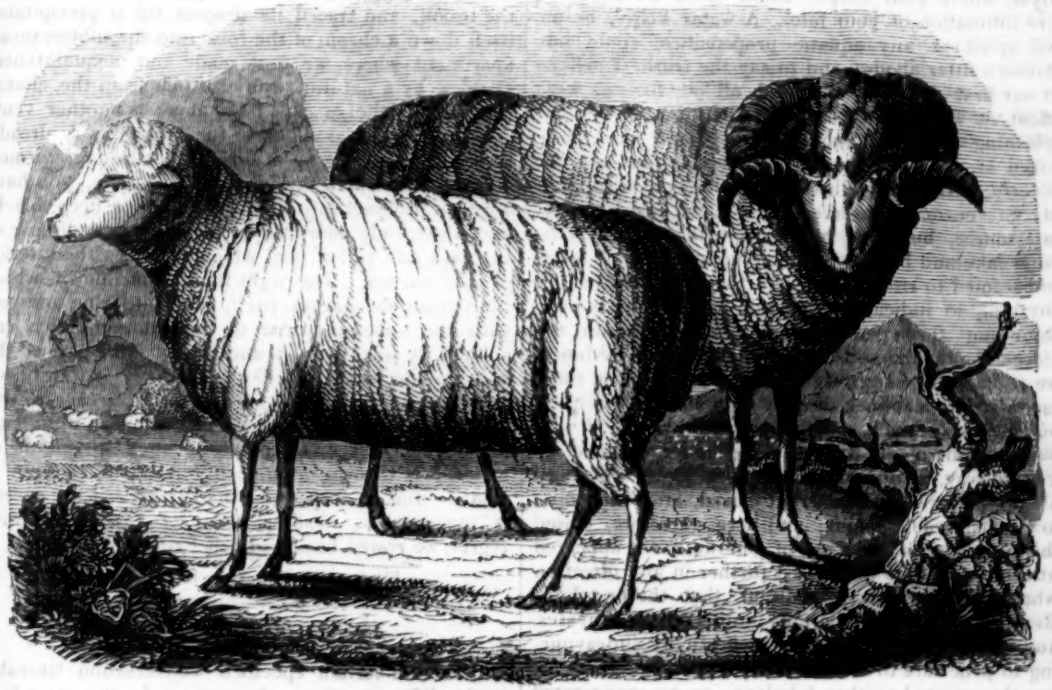
THE WOOLLEN MANUFACTURE. PART I.



THE MERINO SHEEP.

HISTORY OF THE MANUFACTURE.

In the earliest records we possess of the arts of mankind, we find a notice of the employment of wool in the manufacture of clothing. It is mentioned as a common material for cloth in Leviticus. "The garment also that the plague of leprosy is in, whether it be a woollen garment or a linen garment, whether it be in the warp, or the woof, of linen, or of woollen." That the art was possessed by the ancient Greeks and Romans is well known, but at the fall of the Roman empire, the mode of manufacturing fine fabrics appears to have been lost. The woollen manufacture revived a little in the tenth century, in the Low Countries, and continued a source of great profit to the inhabitants for nearly four hundred years, increasing to such an extent, that the growth of wool of their own country was insufficient for their consumption, and they were obliged to derive their supply from other nations. About one hundred and fifty years later, an inundation of the sea, which threatened the whole of the country with destruction, dispersed the foreign manufacturers who had settled in Flanders and Brabant, and they, carrying with them the art they had acquired, established woollen manufactures in other countries, and still continuing their connexion with the Netherlands, increased the commerce of that country to an enormous extent. At the beginning of the thirteenth century the manufacture was established in many parts of Europe; in Spain, in the city of Seville alone, not less than 16,000 looms were employed. From Spain, it extended itself to Italy and France. In France, the manufacture of fine cloths was carried on to a vast extent, from 1659 until the revocation of the Edict of Nantes in 1685, when her best workmen left the country, and her superiority was gradually lost.

With respect to England, there is no doubt that the manufacture of woollen cloths was first introduced by its conquerors, the Romans. A manufactory was established at Winchester, of sufficient magnitude to supply the Roman army; and while the Romans remained on the island, it was, no doubt, continued. From that time to the end of the ninth century, we have no notice of the progress made in this useful art. In the year 925, a fleece was valued at two-fifths of the whole sheep, a tolerable proof either that wool was in great demand, or that the flesh of the sheep was in little request or in great abundance. For the next two centuries, the price of the carcase remained the same, while that of the wool increased. In 1135, the difference in value was very great, the price of the wool having increased fifty per cent, and that of the sheep decreased nearly in the same ratio. In the reign of Henry the Second, Spanish wool was introduced to supply the demand of the nobility for fine cloths, but the injury this was supposed to produce to the sale and consumption of English wool, caused it to be prohibited soon afterwards. In 1240, fine Spanish cloth was imported in considerable quantities, and in consequence, the demand for English wool being reduced, the surplus of our native growth was exported to Flanders, and it was there manufactured. This continued for upwards of one hundred years; at this time, about

1330, great efforts were made by the English to improve their woollen manufacture, and to that end they invited over the Flemings, by the offer of various privileges, to establish manufactories in this country; the great expertness of these people soon produced a sensible improvement in the English fabrics, and the government supposing that the whole of the wool of home growth could be manufactured in the country, a law was passed prohibiting the exportation of wool; the demand from Flanders ceased, and the farmers having less inducement to improve their wool, or to increase the quantity, both suffered by the prohibition.

The different kinds of wool which are employed by the manufacturer, vary much in quality, but the chief distinction is between the *long wool*, called combing-wool, whose fibres are from three to ten inches in length, and the *short-stapled*, or cloth wool, which seldom exceeds four inches. The long wool is employed in the manufacture of carpets, crapes, blankets, &c., the finer and shorter varieties being reserved for hosiery. The short wool is chiefly used for broad cloths, kerseymeres, &c.

The wool of the sheep differs in quality according to the part of the animal from which it is taken; the finest is on the neck and back, the next in quality is on the sides, that on the legs and rump is not so fine, while the coarsest sort is on the under surface of the body of the animal. These four sorts are separated from each other at the time of shearing.

The wool of the English sheep is generally of the long wool kind, the finer sorts of short wool being produced by the Spanish breed of sheep, the Merino; of these, the Saxon Merinos produce the best staple, but those which have been bred in Australia appear likely to excel, in a short time, the European.

King George the Third introduced the Merino sheep into England, but they did not succeed to the extent that was expected, although they have in many instances materially improved the English breed. The quality of wool produced by the same variety of the sheep differs considerably, according to the soil of which their pastures consist. The fleece of sheep fed on chalky districts is generally harsh, while those which are fed on rich loamy soil, are distinguished for the softness of their wool. Those on the Cheviot hills are said to produce the finest English wool.

A very great change has taken place within the course of the present century, both as respects the quantity of foreign wool imported, and the countries from whence it is derived. Previously to 1800, our average imports of wool did not much exceed 3,000,000 lbs., mostly brought from Spain, the wool of which country has long maintained a high character. In 1800, our imports amounted to nearly 9,000,000, and they have since gone on gradually increasing, till they now amount to from 25,000,000 to 43,000,000 lbs. Instead, however, of being principally derived from Spain, as was the case in 1814, the greater part of this immense supply of foreign wool, is now imported from Germany. The late King of Saxony, when Elector, introduced the breed of Merino sheep into his dominions, and exerted himself to promote the growth of this valuable animal. His praiseworthy efforts have been crowned with the most signal success. The Merino sheep seem to succeed better in Saxony and some other German states, than in Spain, and they have increased so rapidly, that the Spanish wool trade has become insignificant, when compared with that of Germany. The importations of German wool were quite trifling during the war, amounting in 1812 to only 28,000 lbs., but since the peace they have increased beyond all precedent. In 1814, they amounted to 3,432,456 lbs.; in 1820, they were 5,113,442 lbs.; in 1825, they reached the enormous amount of 28,739,661 lbs; but this being a year of overtrading, they declined in 1826, to 10,545,232 lbs.; they have since, however, recovered from this depression, and in 1833, amounted to 25,370,106 lbs.

The breed of sheep which was carried out to New South Wales and Van Diemen's Land, has succeeded remarkably well; and Australia promises, at no distant day, to be one of the principal wool-growing countries in the world. The imports into Great Britain have been rapidly increasing; in 1833, they amounted to 3,516,869 lbs., while the imports from Spain only amounted to 3,339,150 lbs. The Spanish flocks suffered severely during the war, and the best wool does not fetch more than half the price of the Saxony.

The males of the Merinos have horns, the females are without them. The thickness of wool with which they are covered is very great,—they appear entirely enveloped in it; it grows under the jaws, down the forehead to the eyes, under the belly, and down the legs to the very feet. It covers the skin so thickly, that it will scarcely give way to the pressure of the hand, but yields, as it were, by starts, like the close, short hair of an extremely fine clothes brush. In Spain, the number of this breed is estimated at 5,000,000, and they are all under the management of a company of proprietors, which bears the name of the *Mesta*, endowed with peculiar privileges, which are considered extremely prejudicial to the interests of agriculture. This association is formed principally of the nobles, persons in power, members of rich monasteries, and ecclesiastical chapters. They are divided into flocks. The *Mesta* has its peculiar laws, which are digested into a code called *Leys y ordenanzas de la Mesta*, and there is also a particular tribunal, consisting of four judges, under the title of *Honrado consejo de la Mesta*, whose jurisdiction extends to all matters that are, in the slightest degree, connected with the interests of the Mesta, and who are particularly watchful against any infringement of its privileges. La Borde, in his splendid work on Spain, sums up the principal grievances complained of, in consequence of the exclusive powers of this corporation. 1st, It employs from 40,000 to 50,000 men, which are thus withdrawn from other pursuits in agriculture, and which are otherwise lost to the state, as they rarely marry; 2nd, The lands on which they feed might be cultivated to much greater advantage; 3rd, The cultivated lands in the neighbourhood of their route receive great damage, for which it is impossible to obtain recompense; and as they are in motion in the Spring, when the corn is considerably advanced, and again in the Autumn, when the grapes are ripe, this damage is the more extensive.

The directors and shepherds are dreaded in every place through which they pass, for they exercise a most insufferable despotism, the consequence of the improper privilege they possess, of bringing whomsoever they may choose to insult before the tribunal of the mesta, whose decisions are almost invariably in favour of its servants.

The following account of these wandering flocks, although written some time back, is still a faithful history of the manner in which they are at present conducted from place to place.

The whole number of these sheep are divided into flocks. Ten thousand sheep compose a flock, which is divided into ten tribes. One man, called a *Mayoral*, has the conduct of all. He must be the owner of four or five hundred sheep; strong, active, vigilant, intelligent in pasture, in the weather, and in the diseases of sheep He has absolute dominion over fifty shepherds and fifty dogs, five of each to a tribe. He chooses them, he chastises them, or discharges them at will; he is the chief shepherd of the whole flock. His salary is forty pounds a year and a horse, whereas the first shepherd of a tribe has but forty shillings a year, the second thirty-four shillings, the third twenty-five shillings, the fourth fifteen shillings, and a boy ten shillings a year. All their allowance is two pounds of bread a day each. They may keep a few goats and sheep in the flock, but the wool is for the master; they have only the lambs and the flesh. The chief shepherd gives them three shillings in April, and three shillings in October, by way of regale for the road; and these are all the sweets these miserable wretches enjoy. Exposed every day in the year to all weathers, and every night to lie in a hut. Thus

fare, and thus live, generally to old age, 25,000 men, the number computed to keep the fine-woolled sheep of Spain, with the same number of dogs of the large mastiff kind, who are allowed two pounds of bread, of an inferior quality, a-piece a day.

The first thing the shepherd does when the flock returns from the south to their Summer downs, is to give them as much salt as they will eat; every owner allows his flock of a thousand sheep, one hundred aroves, or twenty-five quintals of salt, which the flock eats in about five months; they eat none in their journey, nor in their Winter walk. The shepherd places fifty or sixty flat stones, at about five steps distance from each other, he strews salt upon each stone, he leads the flock slowly through the stones, and every sheep eats to his liking. They never eat a grain of salt when they are feeding on limestone land, whether it be on the grass of the downs, or on the little plants of the corn-fields after harvest-home. The shepherd must not suffer them to stay too long without salt; he leads them to a spot of clayey soil, and in a quarter of an hour's feeding, they march to the stones and devour the salt. If they meet a spot of the mixed soil, they eat salt in proportion.

At the latter end of September, they put on the redding or ochre; a ponderous irony earth, common in Spain The shepherd dissolves it in water, and daubs the sheep's backs with it from the neck to the rump. Some say it mixes with the grease of the wool, and so becomes a varnish impenetrable to the rain and cold; others, that its weight keeps the wool down, and so hinders it from growing long and coarse; and others, that it acts as an absorbent of the perspiration.

The sheep now begin their march towards the low plains; their itineracy is marked out by immemorial custom, and by ordinances; and is as well regulated as the march of troops. They feed freely in all the wilds and commons they pass through; but as they must necessarily pass through many cultivated spots, the proprietors of these are obliged by law to leave a passage open for the sheep, through vineyards, olive-yards, corn-fields, and pasture land common to towns; and these passages must be at least ninety yards wide, that they may be not too crowded in a narrow lane. These passages are often so long, that the poor creatures march six or seven leagues a day to get into the open wilds, where the shepherd walks slow to let them feed at ease and rest: but they never stop; they have no day of repose, they march at least two leagues a day, *ever following the shepherd*, always feeding or seeking with their heads towards the ground, till they get to their journey's end, which, from the Montana to Estramadura, is about one hundred and fifty leagues, which they march in less than forty days. The chief shepherd's first care is to see that each tribe is conducted to the same district it fed in the year before, and where the sheep were yeaned, which they think prevents a variation in the wool; though this, indeed, requires but little care, for it is a notorious truth that the sheep would go to that very spot of their own accord. His next care is to fix the toils* where the sheep pass the night, lest they should stray and fall into the jaws of wolves. Lastly, the shepherds make up their poor huts with stakes, branches, and brambles; for which end, and for firing, they are allowed by law to cut off one branch from every tree.

Next comes the time when the ewes begin to drop their lambs, which is the most toilsome and most solicitious part of the pastoral life. The shepherds first cull out the barren from the pregnant ewes, which are conducted to the best shelter, and the others to the bleakest part of the district. As the lambs fall they are led apart, with their dams, to another comfortable spot. A third division is made of the last-yeaned lambs, for whom was allotted from the beginning, the most fertile part, the best soil, and sweetest grass of the down, that they may grow as vigorous as the first yeaned, for they must all march the same day towards their Summer quarters. In the month of March the shepherds cut off the tails of the lambs five inches below the rump, for cleanliness; mark them on the nose with a hot iron; saw off their horns, that the rams may not hurt one another, or the ewes, and any other necessary operation, previously to which the twentieth lamb is paid, the other half tithe being paid in the Winter walk.

* The toils are made of sparto, in meshes a foot wide, and the thickness of a finger; so that toils serve instead of hurdles. The whole square toil is light. Sparto is a sort of rush, which bears twisting into ropes for coasting vessels. Sparto swims, hemp sinks. It is called *boss* by the English sailors.

In the month of April, the sheep express, by various uneasy movements, a remarkable restlessness, and strong desire to go off. The shepherds must exert all their vigilence lest they should escape; and it has often happened that a tribe has stolen a forced march of three or four leagues upon a sleepy shepherd: but he is sure to find them, for they return exactly the same way they came, and there are many examples of three or four strayed sheep, walking a hundred leagues to the very place they fed in the year before. Thus they all go off towards their Summer mountains in the same order they came, only with this difference, that the flocks that go to Leon and Castile, are shorn on the road; whilst the other flocks march on to Molina of Arragon. They begin to shear the first of May, provided the weather be fair, for if this wool were not quite dry, the fleeces, which are close piled upon one another, would ferment and rot. It is for this reason that the shearing-houses are so spacious. Some of them can contain in bad weather 20,000 sheep, and cost above 5,000*l.* sterling; besides, the ewes are creatures of such tender constitutions, that if they were exposed immediately after shearing to the air of a bleak night, they would all perish.

There are one hundred and twenty-five shearmen employed to shear a flock of ten thousand sheep. A man shears twelve ewes a day, and but eight rams. The reason of this difference is, not only because the rams have larger bodies, stronger, and more wool, but the shearmen dare not tie their feet as they do those of the unresisting ewes. Experience has taught that the bold rebellious ram would struggle even to suffocation in captivity under the shears; they gently lay him down, stroke him, and beguile him out of his fleece. A certain number of sheep are led into the great shelter-house, which is a parallelogram of four or five hundred feet long, and one hundred wide, where they remain all day. As many as they judge can be despatched by the shearmen the next day, are driven from the shelter hall, into a long, narrow, low gut, called the sweating-place, where they remain all night, crowded as close together as the shepherd can keep them, that they may sweat plentifully, which is to soften the wool for the shears, and oil their edges. They are led by degrees, in the morning, into the spacious shearing-hall, which joins the sweating-room. The shepherd carries them off as fast as they are sheared to be marked with tar, and as this operation is necessarily performed upon one at a time, it gives a fair opportunity to the shepherds to cull out for the butchery all the sheep of the flock that have outlived their teeth. The sheared sheep go to the fields to feed a little if it be fine weather, and they return in the evening to pass the night in the yard before the house, within the shelter of the walls; but if it be cold and cloudy they go into the house. They are thus brought by degrees to bear the open air, and their first day's journey from the shearing-house to the mountains is short.

The sheep and shearers despatched, the first thing done, is to weigh the whole pile of wool; the next is to divide each fleece into three sorts of wool: the superfine; the fine; and the coarse wool. A different price is fixed upon these three classes, though the general custom is to sell the whole pile together at a mean price. It is sold, after it is washed, when it is to go out of the kingdom, or to any considerable distance in it; for as it never loses less than half its weight in washing, and often more when the sweating is violent, half the carriage is saved.

The shepherd's chief care is not to suffer the sheep to go out of their toils until the morning sun has exhaled the dew of a white frost, and never let them approach a rivulet or pond after a shower of hail, for if they should eat the dewy grass, or drink hail-water, the whole tribe would become melancholy, fast, pine away, and die. Hail-water is so pernicious to men in this climate, that the people of Molina will not drink the river water after a violent shower of hail: but let it be never so muddy, and rise never so high after rain, they drink it without fear.

The fineness of the wool is due to the animals passing their life in an open air of equal temperature. Constant heat or constant cold, with housing, are the causes of coarse, black, and speckled wool. All the animals who live in the open air, constantly keep up to the colour of their sires. The free, but less abundant, perspiration in the open air, is swept away as fast as it flows, whereas it is greatly increased by the excessive heat of numbers of sheep housed all night in a narrow place. It fouls the wool, makes it hairy, and changes its colour.

EASY LESSONS ON CHRISTIAN EVIDENCES.

No. X.

INTERNAL EVIDENCES. PART II.

You may observe, again, that the *kind* of moral duty which Jesus and his Apostles taught, was not what was the most likely to gain them popularity with their hearers. The Jews had a great deal of national pride in being God's holy and peculiar people; they looked on the Gentiles as unclean and outcasts; and had a particular hatred and contempt for the Samaritans. The Romans, again, were no less proud of their military glory, and political power; and the Greeks, of their superior wisdom and refinement. And all were zealous for the glory, and greatness, and superiority, each, of his own country. It was not acceptable to any of these to be taught to "love their enemies," to return good for evil, to be humble and forgiving; patient under persecution; gentle and kind to all men; and lastly, to consider men of every race, and of every station, as on a level in respect of the Gospel promises; and that in God's sight there was to be "neither Greek nor Jew, Barbarian, Scythian, bond nor free." (Coloss. iii. 11.) Moreover, party-spirit ran very high among the Jews; especially between the sects of the Pharisees and Saducees. Now, an enthusiast would have most likely been a zealous partisan of one of these sects; and a scheming impostor, if he did not join one of them, would have been likely to aim at the favour of both, by flattering each in turn, and gratifying each by exposing the faults of their opponents. Jesus, on the contrary, in his discourses to each party, sets before them their own errors, (Luke xi. 42, &c.; xx. 27;) and He does the same in respect of the Jews and Samaritans, (Luke x. 33; iv. 22.)

All this is worthy of a "teacher sent from God;" and is quite different from what we might expect of mere human teachers.

Then, again, if you look to the style of writing in the historical books, (the four Gospels and the Acts,) you will observe that neither the miracles nor the sufferings of Christ or his Apostles are boastfully set forth, and eloquently described and remarked upon; as would have been natural for writers desirous of making a strong impression on the reader. There is no endeavour to excite wonder, or admiration, or compassion, or indignation. There is nothing, in short, such as we should have expected in writers who were making up a marvellous story to produce an effect on men's feelings and imaginations. The miracles performed, and the instance of heroic fortitude displayed, are all related briefly, calmly, and drily, and almost with an air of indifference, as if they were matters of every-day occurrence, and which the readers were familiar with. And this is, indeed, one strong proof that the readers to whom these books were addressed—the early Christians,—really *were* (as the books themselves give us to understand they were,) familiar with these things; in short, that the persecutions endured, and the Signs displayed by the Apostles, really were, in those times and countries, common and notorious.

You should observe, also, the candid and frank simplicity with which the New Testament writers describe the weaknesses and faults of the disciples; not excepting some of the most eminent among the Apostles. Their "slowness of heart," [that is, dulness of understanding,]—their want of faith [trust] in their Master,—and their worldly ambition, and jealousy among themselves, are spoken of without reserve, and as freely as the faults of their adversaries.

This, and some of the other points, in the New Testament, that have been noticed, would be very remarkable if met with in any *one* book; but it is still more so, when you consider that the same character runs through *all* the books of the New Testament, which are no less than twenty-seven distinct compositions, of several different kinds, written apparently at considerable intervals of time from each other, and which have come down to us as the works of no less than eight different authors. You might safely ask an unbeliever to point out the same number, or half the number, of writers in behalf of any Sect, Party, or System, all of them, without a single exception, writing with the same modest simplicity, and without any attempt to excuse, or to extol, and set off themselves.

In this respect, and in many others, both the Christian religion itself, and the Christian Scriptures, are totally unlike what they might have been expected to be if they had been from Man. They appear too simple, candid, and artless, to come from impostors; and too calm, sober, and wise, for enthusiasts. And yet, if Christianity were the device of men, these men must have been either the most deliberate, artful, and wicked of impostors, or else, by far, the wildest and maddest set of enthusiasts that were ever combined together: since they did not (as many crazy enthusiasts have done,) appeal merely to their own inward feelings, and their dreams or visions, but to matters of fact coming under the evidence of the senses; in which none but a complete madman could be mistaken, and most of which their adversaries were free to judge of as well as themselves.

These few heads, then, of internal evidence, which have been here briefly sketched out, would, even alone, furnish good reason for believing that the Gospel did not and could not have come from Man; and that, therefore, it must have come from God. And yet these internal marks of truth which have been here pointed out by way of specimens, are but a very small part of what you may hereafter make out for yourself; and are not even selected as being the principal and the most conclusive, but only as those which could the most easily be put before you in a small compass. At some future time, when your power of judging is improved, you will feel the very character of our Saviour as described in the Gospels, to be (as I have hinted to you,) one of the strongest proofs, and the most satisfactory and delightful proof, of the truth of His religion. But this is rather to be felt than described; and you will feel it only in proportion to your sincere desire and endeavour to conform your own character to the purest and best pattern you can find. The more, indeed, you learn of mankind, and of the Gospel, and the more you study, with a sincere desire to know what is true and to do what is right, both other books ancient and modern and also the Christian Scriptures, the more you will perceive (as has been above said,) how unlikely the Christian religion is to have been devised by Man, and how well suited it is to meet the wants of Man and to improve his nature.

But when you do come to perceive the force of the internal evidence for the truth of Christianity, you will find that though it may be one of the best reasons to *have*, it will often not be the best to *give*. A great part of this kind of evidence is better fitted to furnish a consoling satisfaction to the mind of a believer, than to convince an unbeliever. For there is much of the excellence of the Christian religion that can only be learned fully from experience. Sincere believers perceive in it a wisdom, and purity, and nobleness of character, which are not completely

understood, nor thoroughly liked and relished by any one, till he has *become*, in a great degree, what the Christian religion is designed to *make* him: till he has something of such a character as the Gospel does not *find* in man, but *forms* in him.

A life of genuine Christian virtue does, indeed, meet with some degree of approbation from most men, even though unbelievers; and it appears accordingly to have been, in the earliest times, a help towards the conversion of some of them. (1 Peter ii. 12.) And it is for you to bring before the minds of those you live with this kind of testimony to Christianity from its moral excellence, not so much by talking of it, as by setting it forth in your life, and "letting your light so shine before men, that they may see your good works, and glorify your Father which is in heaven." (Matt. v. 16.) But you must not expect that any one will completely feel all the force of this kind of internal evidence of Christianity, till he shall have become himself a believer, and a sincerely practical believer. It is not easy to give a clear description of the inside of a well-built and commodious house, to one who is on the outside and has never been in such a house, but has always lived in a tent, like the wild Arabs, or in a smoky, slovenly hovel. But you may be able to point out to him enough of what is on the outside, to induce him to desire to come in: and when he *has* done this, he will gradually be able to judge for himself, and by the habits of neatness, order, cleanliness, and decency, which he will be likely to acquire by living in such a house, will gain more and more the power of perceiving the commodiousness of it. And so it is with the evidences of Christianity. As soon as a man has seen enough, as he easily may do, of good evidence to convince him that it is from God, if he will then be induced to *come in*, and heartily embrace it, and endeavour to understand it, and to apply it to himself as so to be the better for it in his life, he will then be rewarded by a fuller and clearer view of many other evidences which he could not at first take in. And such a person will then obtain the fulfilment of that promise of our Master, "If any man is willing to do [will do] the will of God, he shall know of the doctrine, whether it be of God." (John vii. 17.)

Every one would pursue his own interest, if he knew what it was; and, in fact, every one does pursue it, but the generality totally mistake it. No man would choose riches before happiness, power before quiet, or fame before safety, if he knew the true value of each; no man would prefer the transitory and worthless enjoyment of this world, to the permanent and sublime felicity of a better, if he had a clear prospect of them both; but we see the former through a mist, which always magnifies, and the latter appears at so great a distance, that we scarce see it at all; and therefore it makes little impression upon our senses, and has as little influence on our conduct.—Jenyns.

Men of *splendid* talents are generally too quick, too volatile, too adventurous, and too unstable to be much relied on; whereas men of *common* abilities, in a regular plodding routine of business, act with more regularity and greater certainty. Men of the best intellectual abilities are apt to strike off suddenly, like the tangent of a circle, and cannot be brought into their orbits by attraction or gravity—they often act with such eccentricity, as to be lost in the vortex of their own reveries. Brilliant talents in general are like the *ignes fatui*; they excite wonder, but often mislead. They are not, however, without their use; like the fire from the flint, once produced, it may be converted, by solid thinking men, to very salutary and noble purposes.—Trusler.

In forming a judgment, lay your hearts void of foretaken opinions; else, whatsoever is done or said, will be measured by a wrong rule, like those who have the jaundice, to whom everything appeareth yellow.—Sir P. Sidney.

CAOUTCHOUC, or INDIAN RUBBER.

Every age and nation witnesses some new instance of the application of natural productions to the service of man; some new discovery, by which a simple and easily-procured vegetable or mineral body can be made available for his comfort and well being; and as we are justified in believing, that a vast storehouse of such valuable materials lies yet undiscovered, we cannot but arrive at the conclusion, that the amount of knowledge possessed at the present day, will be greatly surpassed by the succeeding age. We must not, therefore, be too vain of our present progress, but merely congratulate ourselves, that we probably stand a degree or two higher in the scale of knowledge than our ancestors.

There is scarcely any subject of inquiry more pleasing or more prolific in instructive results, than the progressive steps by which natural productions become appropriated by man to ease his labours, or to enlarge the number or scope of his pleasures. We shall, from time to time, treat of examples of this nature, feeling assured that our readers will not think the time employed in the perusal misapplied.

Among the vegetable substances which the present generation has seen brought into extensive use by man is Caoutchouc, or, as it is popularly called, Indian Rubber. Its mode of application at the present day, independently of its well-known application in removing pencil-marks from paper, is chiefly under two forms; *first*, an elastic material for belts, straps, and a variety of articles in which great elasticity is desirable; and, *secondly*, as a varnish, which, spread on fibrous bodies, renders them impervious to rain. The weather-beaten traveller is well able to appreciate the value of this varnish, for by its means light articles of exterior clothing are rendered as weather-proof as the ponderous strata of capes, &c. previously employed. This is but one of its valuable applications, and we propose to give a brief account of the vegetable juice from which it is procured.

In the beginning of the last century, some of this remarkable substance found its way into Europe, but its origin was not known until some French philosophers, travelling in South America, perceived the natives making incisions in the trunks of a certain species of tree*, and collecting a juice which exuded from the wound; this juice, upon becoming dry by exposure to the air, was found to be Caoutchouc. The natives called the juice Hhve. Subsequent researches have shown that a juice, more or less resembling the Hhvé, may be procured in a similar manner from various trees growing in warm climates. The *Iatropha elastica*, the *Cecropia peltata*, the *Ficus religiosa*, and the *Ficus Indica* in South America, the *Olquahuitl* in Mexico and Guatemala, the *Urceola elastica* in Sumatra, the *Vahea* in the Isle of France, and some others, have all yielded a milky fluid, which dries into the form of Caoutchouc.

The *Iatropha elastica*, or Syringe Tree of Cayenne, in South America, from which the principal supply is obtained, was described by Condamine (one of the French philosophers before alluded to,) as a tall, straight, branchless tree, except a small tuft of branches at the extreme top. The leaves resemble those of the manioc, green on the upper and white on the under surface. Each of the seed-pods contain three kernels, which, boiled in water, form a sort of butter, or lard, used for culinary purposes in Cayenne.

The juice can be obtained from the trunk at any season of the year, but the rainy season is chosen, as the most productive. An incision being made, the

* A brief account of the Indian Rubber Tree will be found in the *Saturday Magazine*, Vol. II., p. 47.

juice exudes in a state not exactly that of water, milk, or oil, but something like a compound of all three. It is caught in bottles, but the manner in which it was solidified for use was long unknown. It appears, however, that the natives make moulds of clay, or of some other substance easily broken, and cover them repeatedly with layers of the juice, suffering each layer to dry before the next is applied. This process is repeated until the surface has acquired the requisite thickness. The mode of making common dip candles will give a good idea of this process. It is placed in the sun to dry after each application of the fluid, and when the proper thickness is ultimately attained, the mould, with its elastic coating, is held over the smoke of burning vegetables, which gives the Caoutchouc a toughness and consistency nearly resembling leather, and at the same time deepens its colour from a yellowish white to a brown or black. The interior mould is then broken and the pieces extracted, and the dried surface is then the Caoutchouc, or Indian Rubber of commerce.

The natives apply this substance to many useful purposes. They make it into tubes, about two feet long, and one and a half inches thick, which they use as flambeaux; they give a good light, emit but little smell, and last about twelve hours each. Again, they make it into bottles with very narrow necks, through which a hollow reed is inserted; the bottles are then filled with water, and one is given to each visiter at an Indian entertainment; the reed is put into the mouth, the bottle is squeezed by the hand, and the water is thereby squirted through the reed. This odd mode of supplying the guests with drink obtained for the tree from which the Caoutchouc is procured, the name of the syringe-tree, syringe being the name for a squirt.

Of course, whatever the form of the mould may be, the Caoutchouc assumes a similar form; and the Indians make many articles, both for use and ornament, by this means, since by stamping it before perfectly dry, they can impress any device or figure they please upon it. If a given weight, say one pound, of the juice be solidified in this way, it is found that about one half of it evaporates; the solid Indian Rubber being (if the tree be old,) rather more, and (if it be young,) rather less, than half the original weight. The inhabitants of Quito make a sort of sail-cloth from this substance.

The form in which it has generally been brought to Europe is that of globular, narrow-necked bottles, varying in capacity from half a pint to a quart, and the thickness of which varies from a quarter of an inch to one inch. When it was first known in Europe that these bottles had been in a fluid state, and that the fluid had exuded from the trunk of a tree, many attempts were made to reduce it again to the fluid state, in order that it might be applied to various purposes with increased facility. Macquer, Condamine, Labordey, Bomare, Grossart, and other eminent Frenchmen, subjected it to various processes, in order to transform it into the liquid state. Macquer, thinking that it was a compound of an oily and a watery fluid, and that the solid form was assumed in consequence of the watery part evaporating, tried to dissolve it with an oily liquid, such as linseed-oil or essence of turpentine, but failed; he, however, succeeded with rectified oil of turpentine, but found that, though he got it into a fluid state, he could not restore it to its solid condition. He then tried boiling, but failed in dissolving it. At last, after numerous trials, he thought of employing ether, a liquid possessing many curious properties; he cut the caoutchouc into very small pieces, and putting them into very pure sulphuric ether, they were dissolved, and upon operating upon the ethereal solution in the same way as the Indians do with the original juice, he found that, as the ether evaporated, the solid Indian Rubber was restored to its former condition.

This success was important, as it enabled Macquer and others to transform it as occasion might require. Macquer used to make hollow tubes of Caoutchouc, by coating a stick or cylinder of wax with his new solution, and when the proper thickness was attained, by plunging the whole into hot water, the wax was melted and flowed out of the tube. In a similar way Frederick the Great of Prussia had a pair of Indian Rubber boots made; a cast of his leg was taken in clay, and then coated with the solution, after which the mould was broken and taken out piecemeal, leaving a pair of well-shaped, seamless, water-proof boots.

The great expense of using ether for this process prevented the manufacture from being carried on to any great extent, and other attempts were made to render the tough Caoutchouc as it was imported, capable of being changed in form. One such plan was devised by Grossart, viz., to cut it into small pieces, and boil it in water for about a quarter of an hour, at which time it assumed somewhat the state of stiff putty, and then by squeezing it, piece by piece, into a mould, the pieces adhered together and assumed the form of the mould, the Caoutchouc being repeatedly heated during the process; but it is evident that this mode did not admit of much accuracy.

Another mode by which it could be changed into useful forms, was by cutting the bottle-shaped masses into strips of the necessary size and shape, dipping the edges into hot water and applying two edges together; if well managed, the seam became as strong as any other part of the substance. But the desire of obtaining it in a liquid state prompted further experiments; and at different times, and in different countries, the following processes have been recommended.

1. Put the Caoutchouc (cut in small pieces) into an iron ladle over a clear fire, and, when a white smoke rises, pour drying linseed-oil upon it, (one quart to two ounces of Caoutchouc,) stir it well with a metal spoon, and it will attain a sufficiently liquid state for use.

2. Boil the Caoutchouc for one hour in water, then cut it into slender threads and boil it for another hour, after which put it into a well-stopped bottle with sulphuric ether, and in a few days it will be dissolved. In some instances nitrous ether is employed.

3. Into one pound of spirit of turpentine, gradually heated, put one pound of Caoutchouc, cut into very small pieces and thrown in by degrees. When all is dissolved, pour in a pint of drying linseed-oil, and boil the mixture for a quarter of an hour.

It will be obvious that the liquid when once prepared, may be either used as a varnish for surfaces, or to take impressions by being poured into moulds. In the former state it has been extensively employed for varnishing balloons, and for strengthening the seams or joinings, which are unavoidably necessary in their construction.

A few years ago a bottle of the liquid juice, or *Hhvé*, was brought to England, and subjected to chemical investigation by Dr. Faraday. When spread in thin pieces it soon dried, and became like ordinary Indian Rubber. When mixed with water it separated into two portions; a whitish light solid rose to the surface, and a brown liquid sank to the bottom. This white solid is pure Caoutchouc, for the mode of drying the Caoutchouc of commerce over a smoky

fire necessarily causes many impurities to dry in with it.

Caoutchouc is placed by Professor Brande, (*Manual of Chemistry*, p. 981,) among the Resins, although, as he admits, it belongs more strictly to the modifications of hydrocarbon, since it consists, when deprived of all adhering impurities, of carbon and hydrogen only. It is scarcely acted upon by strong acids and alkalis. It burns in the air with a bright smoky flame, and in oxygen gas with vehemence, attended with a copious deposit of carbon, which adheres to the gas-jar. When subjected to destructive distillation, it affords a quantity of a highly volatile and inflammable liquid, hydro-carbon, the specific gravity of which is only 0·64; that is, it is rather more than half the weight of an equal bulk of water. This liquid dissolves Caoutchouc itself, and many other substances useful in the arts.

When the solid Caoutchouc was once liquified, it is natural to expect that it would be applied to many economical purposes; and water-proof cloth of various kinds has been for some years in vogue. In some of these instances, the solid Indian Rubber is cut by an ingenious machine into very fine threads, which, by another process, are covered with a filamentous envelope, and then interwoven with the other materials of the cloth, whether woollen or cotton, sometimes occupying the long way of the threads, and sometimes the width of the cloth, (called, technically, the warp and woof). In this way various articles of clothing have been made. But, about fourteen years ago, a mode of employing liquid Indian Rubber was devised, and a patent taken out for it. This process we will briefly describe.

There are in the gas-works, which are now to be found in almost every city of Great Britain, large vessels called gasometer-tanks, which contain ammoniacal liquor, produced during the process of making gas; to the surface of this liquid there rises another liquid, lighter than the former, and very volatile; this is called coal-oil, and is a species of naptha, or liquid-coal.

It was discovered that this coal-oil was a perfect solvent for Indian Rubber, and an immediate application of it to that purpose was made. This coal-oil used previously to be thrown away as of no value, and could therefore be purchased at a cheap price.

When the cloth proposed to be made water-proof is ready for use, one piece is stretched upon a frame, and the liquid Indian Rubber is spread on it with a brush, and smoothed with a spatula; another piece of cloth of the same size is then lain upon the first, and the two are then pressed between two rollers to make them adhere. When dry, the two thicknesses of cloth are found to be inseparably united by the cement existing between them, and not a particle of water can penetrate through that stratum of cement. This very successful mode of application has brought water-proof cloth into extensive use for outer garments. It has, however, been shown within a few months, that a mode of making double cloth, by a cement of Indian Rubber between two layers of cloth, was practised before the use of the coal-oil was discovered. In the West Indies, twenty years ago, a cloth was made by spreading a layer of the original juice (the Hhvé,) as it exudes from the tree upon a piece of cloth, and then laying another piece of cloth upon the first, and the whole cohered together. It will be recollected, that the English aëronaut, Mr. Green, ascended in a balloon on the day of the coronation of George the Fourth, in 1821; that balloon was made of double silk, cemented together by Caoutchouc dissolved in oil of turpentine by a peculiar process, and was afterwards rendered unfit for use by falling into the sea. The silk was, however, cut up into convenient pieces, and used as water-proof cloaks, &c. for several years by different persons. The reader will find much interesting information concerning Indian Rubber cement in the report of a trial, Mackintosh *v.* Everington, (concerning infringement of Patent,) in the Repertory of Patent Inventions for 1836.

Indian Rubber, in its solid form, is very valuable for many surgical instruments. There are many delicate operations in surgery, in which great elasticity in the instrument is required, at the same time that a capability of resisting fluids is necessary. Indian Rubber is fitted for this both ways, for if soaked for a short time in warm water, it may be stretched to seven or eight times its natural length; and it will resist the action of watery, spirituous, saline, acid, and oily fluids. A bottle formed of this solid, if strongly blown into, will greatly expand in size; and if it be previously softened, it may be blown out into a balloon of four or five feet diameter, and so thin, that if filled with hydrogen gas it would ascend. The juice Hhvé, as it exudes from the tree, is a little heavier than water, but when it has become dry by evaporation it is a little lighter than water.

We have thus briefly detailed the principal circumstances connected with this remarkable substance. There is no doubt that it will be found available for many more purposes than those to which it is at present applied; the property of extensive elasticity is so very requisite in many of the applications of the arts, whether for use or ornament, that we may reasonably expect new modes of adapting Caoutchouc to those purposes. We may remark, in conclusion, that very old drying linseed-oil, when spread in a thin layer, and left for many months exposed to the sun, assumes a consistency very much resembling Indian Rubber, and may be used for many of the purposes to which the latter is applied T.

TO AN INFANT.

Sweet infant, when I gaze on thee,
And mark thy spirit's bounding lightness,
Thy laugh of playful ecstasy,
Thy glance of animated brightness,
How beautiful the light appears
Of Reason in her first revealings,
How blest the boon of opening years,
Unclouded hopes, unwithered feelings!

Thou hast not felt Ambition's thrall,
Thou dost not sigh for absent treasures,
Thy dark eye beams in joy on all,
Simple and artless are thy pleasures;
And should a tear obscure thy bliss,
I know the spell to soothe thy sadness,
The magic of thy father's kiss
Can soon transform thy grief to gladness!

The world, my fair and frolic boy,
May give thy feelings new directions,
But may its changes ne'er destroy
The fervour of thy warm affections!
Still may thy glad contented eyes
Smile on each object they are meeting,
Yet, most of earthly blessings, prize
A parent's look—a parent's greeting!

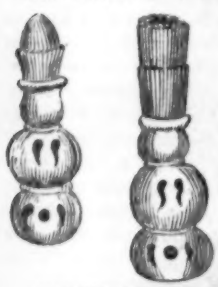
And, oh! may He whose boundless love
Excels the ken of human blindness,
The wisest father's care above—
Beyond the fondest mother's kindness—
Teach thy young heart for Him to glow,
Thy ways from sin and sorrow sever,
And guide thy steps in peace below,
To realms where peace endures for ever!—M. A.

CLEANLINESS IN ANIMALS.

The universal instinct which points out the necessity of cleanliness, is beautifully displayed in many of those animals in which we might be least likely to expect it. We all know the great care bestowed on its fur by the domestic cat, and by all the other animals of the same group; and many similar instances fall within our knowledge of the same feeling in other quadrupeds; but the following facts show that some creatures, which we are in the habit of looking upon with a feeling approaching disgust, teach the same lesson to humanity. The instance we are about to mention, came under the observation of Mr. Rennie, while on an excursion for the purposes of natural history. The insect which is the subject of it proved to be larva of the female glow-worm; it had been placed in a box along with some small snails, and was examined on the succeeding day.

After (says Mr. Rennie) watching it for some time, my attention was drawn to some very singular movements which it made with its tail, which the reader will better understand, if he will remember how the common earwig bends up its tail over its back, somewhat in the manner of a spaniel when he trips after his master. There appeared to be something so uncommon in these movements, that my curiosity was excited to observe them more minutely; and, as the creature was not at all timid, I could easily observe it through a glass of some power.

The result of this observation was the discovery of the curious instrument shown in fig. 1; with this the insect was employed cleaning itself, and it would be difficult to devise anything more effectual for the purpose, though its action is different from all others of the kind with which we are acquainted. It consisted of a double row of white rays disposed in a circle, one row within the other, and retractile, like the horns of a snail. It operated by suction, and not as a comb, a brush, or a wiper. The end of this instrument was cupped, forming a kind of pocket, into which was collected whatever dust, or other impurities, were collected from the body, till it could hold no more; when, by a spiral movement of the rays, the accumulated pellet was thrown out, and placed with great care in some place where it might be out of the way of again soiling the glossy skin of the insect.



GLOW-WORM'S BRUSH.

GLOW-WORM USING ITS CLEANING-BRUSH.

Fig. 2 is the insect of the natural size. The food of this creature, such as snails and other animal substances, rendered an instrument of this kind necessary to preserve its body in a state of cleanliness.

We find a similar provision for the same purpose in many other animals; the foot of the night-jar has a comb-like appendage to the longest toe of the foot, which enables the bird to keep its feathers in order, and free from vermin.

During the course of a series of observations and experiments, on the process by which spiders can shoot lines of thin gossamer silk across a brook or other intervening obstacle, it was indispensable, says Mr. Rennie, that I should pry with minute attention into their every movement, and I was soon struck with one, which interested me not a little. The creature appeared to be mumbling, if I may use the term, its legs between its mandibles, drawing each leisurely along, as a dog may be seen to gnaw a bone when not very much in earnest, but more by way of pastime than of making a dinner. I could not at first account for this; the ancient naturalists, who drew largely on their imagination when facts failed them, would at once, I have no doubt, have leapt to the conclusion that the spider, in default of prey, actually devoured its own legs, as it has been asserted to do its web. A little attention convinced me, that the movements alluded to were precisely of the same kind as the preening of birds. Spiders have their legs more or less covered with scattered hair, which, being rather long and bristly, is apt to catch up bits of their own web and other extraneous matters, and these, from the delicacy of their semitransparent skin, must produce uncomfortable irritation. To free themselves from this is one of their daily occupations; and when a spider appears to the less minute observer to be quite at rest, it will often be seen, on close inspection, to be assiduously and slowly combing its legs in the manner I have mentioned.

FOOT OF BLUE-BOTTLE.

We all have seen the little house-fly busily engaged in cleaning itself with its feet. The above engraving shows the cleaning apparatus on the foot of the blue-bottle fly.

Every human creature is sensible of the propensities to some infirmity of temper, which it should be his care to correct and subdue, particularly in the early period of life; else, when arrived at a state of maturity, he may relapse into those faults which were originally in his nature, and which will require to be diligently watched and kept under through the whole course of life; since nothing leads more directly to the breach of charity, and to the injury and molestation of our fellow-creatures, than the indulgence of an ill temper.—Blair.

KNOW THYSELF.

Let him stand who will on the giddy height
Of the palace-top in his pride of place!
In a humbler home may my heart delight,
Where my couch is low, and my pillow,—peace.
Be it known to few how my life flows on,
As I silent sail on its noiseless tide!
When its days and years are expired and gone,
Let my record be that,—I lived and died!
For sadly he meets the stroke of death,
(At the ends of earth though his name be known,)
Who laments, when yielding his final breath,
That he's known to all but himself alone.

Mordaunt Barnard, *Amwell.*

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